

PATENT APPLICATION  
Docket No.: NC 82,591

REMARKS

Claims 1-19 are pending in the application. Claims 11-16 are presently allowed.

Claims 1, 10, 11, and 16-18 are amended to refer to the reactants as "components," rather than "compositions."

Claim 1 is amended to add the missing word "benzene."

Claims 2-10 are amended to change "mixture" to "composition" as recited in parent claim 1.

Claim 11 is amended to cancel "said" before a component that did not have antecedent basis.

Claim 16 is amended to cancel the limitation "for at least one hour." This limitation is now in new claim 19.

Claim 17 is amended to correct grammar and subscripting.

Claim 18 is amended to correct grammar.

New claim 19 recites the cancelled limitation from claim 16.

None of the amendments are narrowing amendments.

Claim Objections

Claims 2-10 were objected to for the recitation of "mixture" instead of "composition." By this amendment, this has been corrected.

Claim 1 was objected to for omission of "benzene." By this amendment, this has been corrected.

Claim 1 was objected to, suggesting that "composition" be changed to "component." By this amendment, this has been corrected.

Claim 17 was objected to, suggesting that "Rx" and "Ry" be changed to "R<sub>x</sub>" and "R<sub>y</sub>." By this amendment, this has been corrected.

Claim Rejections – 35 U.S.C. § 102

Claims 1-10, 17, and 18 were rejected under 35 U.S.C. § 102(b) as anticipated by Ting et al. (US 5,389,400).

Claim 1 (2-10 dependent thereon) is to a composition formed by heating to a temperature of at least about 300°C a mixture of a ferrocenylethynyl containing component and an aromatic

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acetylene containing component. The resulting composition has iron nanoparticles dispersed homogenously throughout. Claim 17 (18 dependent thereon) is similar to claim 1, but is broader in that a broader class of organometallic components is recited, and the presence of nanoparticles is not recited.

Ting discloses a diamond/carbon/carbon composite having a preform of carbon fibers densified by deposition of carbon between the fibers and a deposited layer of diamond on the preform (Abstract). The carbon fibers are grown by chemical vapor deposition with iron nanoparticles as the catalyst (col. 5, line 2-col. 6, line 11).

In order to make a *prima facie* case of anticipation, each limitation of the claims must be disclosed in the reference. Ting is not conclusive as to whether any iron nanoparticles are present in the composite, as recited in present claim 1. The iron nanoparticles are used as a catalyst for growth of carbon fibers. The fibers are then cut and placed into a mold. Ting nowhere discloses that the nanoparticles are also placed into the mold. Ting does not disclose whether the nanoparticles are adhered to the fibers. Even if the nanoparticles are adhered, as the fibers grow from the nanoparticles, the nanoparticles would be present at the ends of the fibers. When the fibers are cut, the portion of the fibers containing the nanoparticles may be cut off.

Notwithstanding the possible lack of iron nanoparticles, Ting also differs from the invention of claim 1 in that any iron nanoparticles that could be present would not be homogenously dispersed in the product. It is known that a preform generally contains fibers that span the length of the preform, so any fiber ends that have nanoparticles would be at either one end or the other of the preform. This is not a homogenous dispersion. Although it may be possible to purposely arrange the fibers with their ends in the middle of the preform so that the nanoparticles are located at different points in the preform, such arrangement is not disclosed in Ting.

Even assuming that iron nanoparticles are present in the composite of Ting, the composite still does not possess all of the claim limitations. The claimed product can occur in at least two forms: a form free of carbon nanotubes (CNTs) and a form containing CNTs. Each will be discussed separately. The CNT-free form bears the most resemblance to the densifying carbon matrix occurring between the carbon fibers in Ting, rather than to the composite of Ting as a whole. This matrix is made by either chemical vapor infiltration or pitch infiltration (col. 4, lines 31-34). This matrix differs from the invention of claim 1 in that it does not contain iron

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nanoparticles. In Ting, the iron nanoparticles are used to catalyze the growth of the carbon fibers and as such are found in the fibers and not in the densifying matrix. However, claim 1 recites that iron nanoparticles are dispersed homogenously throughout. As to claim 17, the claim requires the presence of Fe, Mn, Ru, Co, Ni, Cr, and/or V. None of these elements would be introduced into the carbon matrix of Ting by the disclosed methods of chemical vapor infiltration and pitch infiltration. Thus, the processes recited in the present product-by-process claims do not produce a carbon matrix as disclosed in Ting that is free of any metallic elements.

After the present application was filed, it was discovered that the iron-containing product as claimed in claims 1 or 17 could contain CNTs. This is stated in the attached Declaration of Teddy M. Keller. Although not recited in the claims, the CNTs can inherently be present. This form of the claimed product most resembles the carbon/carbon composite of Ting without the diamond layer. However, there are at least two significant differences. The fibers of Ting are much larger in diameter than the CNTs of the present invention. CNTs are known to generally have diameters of no more than tens of nanometers. Ting does not state the dimensions of the fibers, however it is disclosed that the preforms were made by lay-up of carbon fibers that were cut to the dimensions of a mold (col. 6, lines 11-14). This implies that the fibers were not carbon nanotubes, but were macroscopic or else they could not have been so handled. The disclosure of Ting is not enabling of the lay-up of carbon nanotubes as such would certainly require special equipment.

The composite of Ting further differs from the CNT form of the invention in that the fibers of Ting are aligned in parallel as in Figs. 1 and 2. The attached Declaration states that the CNTs are randomly arranged, rather than in a regular pattern. This occurs because the CNTs (and the nanoparticles) are formed *in situ* as the mixture is heated, rather than purposely arranged as in Ting. Thus, the processes recited in the present product-by-process claims do not produce a composite as disclosed in Ting, having parallel, macroscopic carbon fibers, with or without iron nanoparticles only at the ends of the fibers.

In view of the foregoing, it is submitted that the application is now in condition for allowance.

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Respectfully submitted,



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